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PATENT ABSTRACTS OF JAPAN

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(54) SHADOW-MASK MATERIAL

(57)Abstract:

PURPOSE: To develop an Fe-Ni shadow-mask material for the high-definition color television picture tube having more uniform etching drillability than before.

CONSTITUTION: This shadow-mask material excellent in etching drillability contains 35-37wt.% Ni and the balance Fe with inevitable impurities, and the total length of the inclusion in the rolling direction is controlled to $\leq 10\text{mm}$, preferably to $\leq 5\text{mm}$, per 50mm² of the cross section parallel to the rolling direction. Since the total length of the inclusion is thus controlled, the etching speed in the depth direction is not decreased by the inclusions including the minute inclusion, and a tiny hole is precisely bored. The raw material, melting condition, casting condition, etc., are adjusted. This shadow-mask material is applicable to the high-definition color television picture tube.

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3. In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] Including 35-37% % of the weight nickel, the remainder consists of Fe and an unescapable impurity, and it is 2 50mm of rolling parallel cross sections. Shadow mask material excellent in the etching punching nature characterized by the inclusion rolling-direction total length of a hit being 10mm or less.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This inventions are the Fe-nickel system high definition which was excellent in the etching punching nature which regulated the inclusion total length in a rolling parallel cross section especially about the shadow mask material used for the picture tube for color television, and a thing about the shard USUKU material for the picture tubes for super-high definition color television further.

[0002]

[Description of the Prior Art] The shadow mask is used for the color-television picture tube as an electrode for color sorting.

[0003] As a material for shadow masks, although the low carbon aluminum killed steel has so far been used, recently, the umber alloy (Fe-36%nickel) which has a low-fever expansion property is used more often.

[0004] It is based on the following reason. That is, since bombardment [electron beam / the electron beam dispatched to the shadow mask passes puncturing of a shadow mask and also / the non-aperture front face of a shadow mask] directly when operating the color picture tube, a shadow mask is heated, so that it sometimes amounts to no less than 80 degrees C. Under the present circumstances, although the fall of color purity arises that thermal expansion is a large material according to the thermal expansion of a shadow mask, the fall of the color purity by this thermal expansion will be prevented by use of the low Fe-nickel system umber of coefficient of thermal expansion.

[0005] Although there are some manufacture methods, after repeating rolling and annealing and making Fe-nickel system umber material into the shadow mask material of suitable thickness with the last cold rolling through forging from an ingot typically, such a shadow mask performs the last recrystallization annealing if needed, and is produced by forming much punching there by etching of the common knowledge which uses ferric chloride. Then, the process of common knowledge, such as fabrication and melanism processing, is carried out, and a shadow mask is manufactured.

[0006]

[Problem(s) to be Solved by the Invention] However, it poses a problem that this Fe-nickel system umber alloy is inferior in etching punching nature compared with the conventional low carbon aluminum killed steel.

[0007] Then, in order to improve the etching punching nature of an umber alloy,

restricting C, Si, P, S, O, and N as an impurity is already proposed (JP,64-25944,A). However, to be sure, when it is the super-high definition mask with which the increase in need will be expected from now on although etching punching nature improves by restricting C, Si, P, S, O, and N as shown in this JP,64-25944,A, still it is not enough and to raise etching punching nature further is desired.

[0008] The technical problem of this invention is developing the shard USUKU material which can respond to the Fe-nickel system super-high definition color-television picture tube which has etching punching nature more uniform than before, and need's will be expected to be from now on.

[0009]

[Means for Solving the Problem] This invention persons found out that etching punching nature improved with restricting the total amount of inclusion quantitatively proper, as a result of doing various researches in view of this point. It found out that it was important to regulate the inclusion rolling-direction total length per rolling parallel cross section especially. Based on this knowledge, including 35-37% % of the weight nickel, the remainder consists of Fe and an unescapable impurity, and this invention is 2 50mm of rolling parallel cross sections. The shadow mask material excellent in the etching punching nature characterized by the inclusion rolling-direction total length of a hit being 10mm or less is offered.

[0010] It is the cross section of the thickness direction in a vertical plane with a "rolling parallel cross section" parallel to the rolling direction of the shadow mask material rolled out here. Total of the length of each rolling direction of two or more inclusion observed in the cross section is called "inclusion rolling-direction total length." Inclusion is extended long and slender along with the rolling direction, and the total influences etching nature greatly.

[0011] And it sets to the above-mentioned shadow mask material, and the still more desirable range is 2 50mm of rolling parallel cross sections. The inclusion rolling-direction total length of a hit is 5mm or less.

[0012]

[Function] By regulating the inclusion rolling-direction total length per rolling parallel cross section, the falls of the etching speed to the depth direction by inclusion including minute inclusion can be prevented, and a detailed hole can be opened with a sufficient precision.

[0013]

[Example] this invention is aimed at the Fe-nickel system shard USUKU material which contains nickel 35 to 37% of the weight. In order to reduce inclusion, it is

desirable to restrict C, Si, P, Mn, S, O, and N content as advocated from the former. It is desirable to restrict these impurities as follows especially (% of the weight).

C : 0.015% or less (preferably 0.005% or less), Si:0.001-0.15% (preferably 0.001 - 0.05%)

P : 0.010% or less (preferably 0.003% or less), Mn:0.1-1.0%, S : 0.005% or less, O : 0.0100% or less, N : 0.0050% or less, [0014] Fe-nickel system shadow mask material repeats rolling and annealing after forging from the ingot ingot of the proper composition manufactured by for example, vacuum melting and casting, and is the last cold rolling. It is produced by the photo etching technology of the common knowledge which performs the last recrystallization annealing or stress relief tempering if needed, applies a photoresist for much punching there after considering as the shadow mask material of suitable thickness, carries out etching processing by etching reagent like [after printing and developing a pattern] ferric chloride, and removes a resist after that.

[0015] Before, in shadow mask material, it was known qualitatively that the fewer one of inclusion is good. it -- inclusion -- the margin of an aperture -- hitting -- a hole -- it was because the poor stripe from which the defect who makes a configuration deform, or the inclusion which stood in a row for a long time happens by exposing to an etching wall surface is started and the quality of a shadow mask is reduced Therefore, the size of the inclusion which becomes a problem there was thing at most 5 micrometers or more, and less than 5-micrometer minute inclusion was expected to be satisfactory, and was not conventionally set as the object of consideration.

[0016] However, the amount of inclusion in a shadow mask, etching nature, and as a result of specifically inquiring about a relation with the etching speed to the depth direction, it came to find out that the minute inclusion considered not to become a problem conventionally has big influence on etching nature. Including the minute inclusion considered that it does not become a problem conventionally, if there are many amounts of inclusion, it will become the obstacle of the etching speed to the depth direction falling in etching of a shadow mask, and opening a detailed hole with a sufficient precision. It is important for etching nature to regulate the total amount not only including big inclusion but minute inclusion. Although it crawls directly and is not checked yet about the mechanism, it thinks as follows.

[0017] Since inclusion does not dissolve by the reaction of etching, it remains in the bottom of the hole of the shadow mask under etching, and blocks contact of a new etching reagent and material. Therefore, the etching speed to the depth direction falls.

[0018] Although a problem did not actualize since it was tended besides the hole in the conventional shadow mask with a comparatively large hole to carry [spray ** of an

etching reagent] out this inclusion that did not dissolve, it becomes a big problem because a hole is small when manufacturing the mask of a super-high definition which need will increase by from now on.

[0019] Then, this invention person reached the conclusion that the index of the rolling-direction inclusion total length per rolling parallel cross-section unit area was suitable for the etching speed and correlation attachment ** to the depth direction, as a result of repeating the research which specifies quantitatively the influences of inclusion also including the minute inclusion exerted on etching. In this invention, the reflection-electron composition image of SEM was incorporated to image-analysis equipment, and the rolling-direction inclusion total length per two index of being expedient was used for measuring by picture measurement 50mm of rolling parallel cross sections. This carries out the speculum of the shadow mask material perpendicular thickness cross section parallel to a rolling direction, measures the length of the rolling direction of the inclusion of existing a large number, respectively, and takes the total. Inclusion is extended long and slender along with the rolling direction, and regulates the amount of whole quantitatively by regulating the total length in the rolling direction. However, although these keep few intervals, and it becomes one relation and exists about the inclusion of B system set to JIS in this case, only the length of each inclusion itself which is not the whole series length and constitutes one relation of the inclusion of B system shall be measured, and the sum total shall be taken (the interval between adjacent inclusion is not included).

[0020] It is 2 50mm of this rolling parallel cross section. Since the etching speed to the depth direction fell partially, uniform etching nature fell and it stopped having been suitable as an object for super-high definition masks when the inclusion rolling-direction total length of a hit exceeded 10mm, the upper limit was set to 10mm. In addition, the still more desirable range is 5mm or less.

[0021] The amount of inclusion is controllable by managing a raw material, dissolution conditions, casting conditions, etc.

[0022] On the occasion of etching, the crystalline structure is also important. In relation to this, as for this applicant, the grain size number has advocated the shadow mask material which the degree of set of 9.0 or more and the {100} sides to a rolling side made less than 35% and which was preferably made into less than 15% by the grain-size number in this application and the patent application on the same day. so that crystal grain is small -- the hole after etching -- a configuration and an etching wall surface become smooth, and the quality of a mask improves a grain size number carries out to 9.0 or more by the grain-size number -- the hole after smooth etching -- a configuration

and an etching wall surface are guaranteed By making the degree of set of the {100} sides to a rolling side into less than 35% as crystal orientation, crystal orientation becomes random and improves etch uniformity. This combined use is not barred in this invention.

[0023] (An example and example of comparison) Although the test specimen was fundamentally manufactured by vacuum melting, in that case, it changed a raw material, dissolution conditions, casting conditions, etc., and changed the content of inclusion. Cold rolling and annealing were repeated after casting and hot rolling, and this was made into the cold-rolled board of 0.15mm of board thickness. It is 2 the chemical composition of a test specimen, and 50mm of rolling parallel cross sections. The inclusion total length of a hit is shown in Table 1. The inclusion total length incorporated the reflection-electron composition image of SEM to image-analysis equipment, and measured it by picture measurement. The size of 1 pixel in that case is 1 micrometer.

[0024] Next, the etching examination was performed to this test specimen, and the etching speed to the depth direction was evaluated. The etching reagent used ferric chloride solution using what [for super-high definitions] has a mask pattern small [the diameter of puncturing]. Etching was performed at 70 degrees C and the depth of the puncturing center section after fixed time estimated etching speed. Etching speed is also collectively shown in Table 1.

[0025]

[Table 1]

[0026] The example of this invention is quickly excellent in the etching speed to the depth direction so that clearly from Table 1. Especially, it turns out that especially the thing 5mm or less is excellent in the inclusion total length.

[0027]

[Effect of the Invention] It can succeed in developing the Fe-nickel system shadow mask material which has etching punching nature more uniform than before, and can respond to the high definition which need is increasing by recently, and also the shadow mask for the picture tubes for super-high definition color television.

[Translation done.]